



Mikrotik User Meeting Bogotá Colombia

Mejorando las redes WLAN corporativas con



Por : Sergio Acuña
QuickNET.co



sergio.acuna@quicknet.co

QuickNET.co

Agenda

- Objetivos e Importancia de una WLAN exitosa
- Importancia del Site Survey
- Recomendaciones de diseño
- Funcionalidades Mikrotik
 - Manipulación de MCS/Datarates
 - Control de potencia TX
 - Control Intensidad de Señal RX
 - Control de Tráfico
 - Firewall de hardware (RB951G)
- Mejorando el Roaming
- Mejorando la Capacidad
- Mejorando la Cobertura
- Desempeño en la vida real

Objetivos e Importancia de una WLAN exitosa

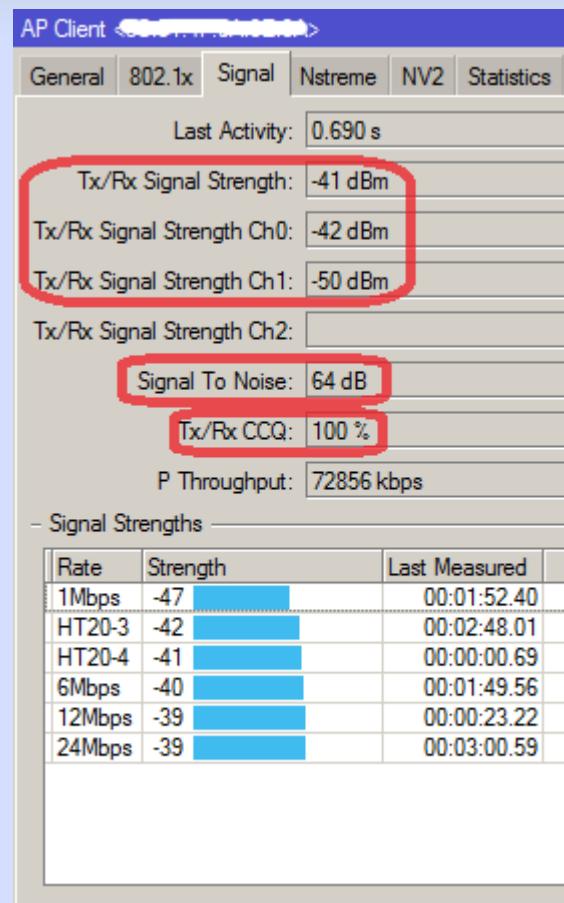
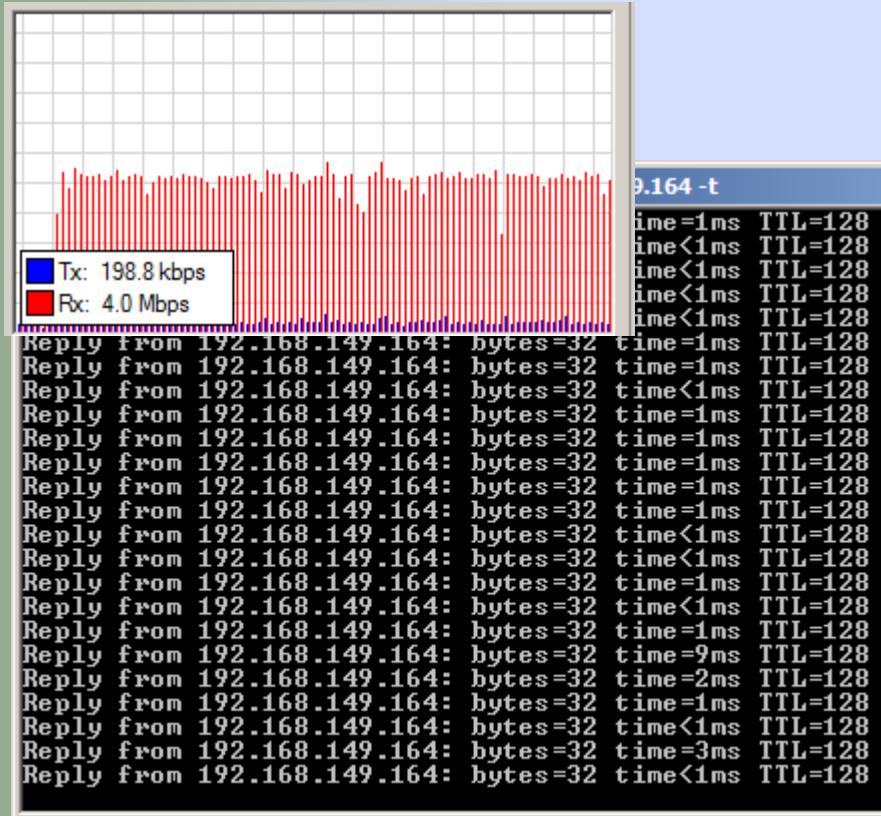
- Rendimiento/Capacidad



Mikrotik + WLAN= Mejores Resultados

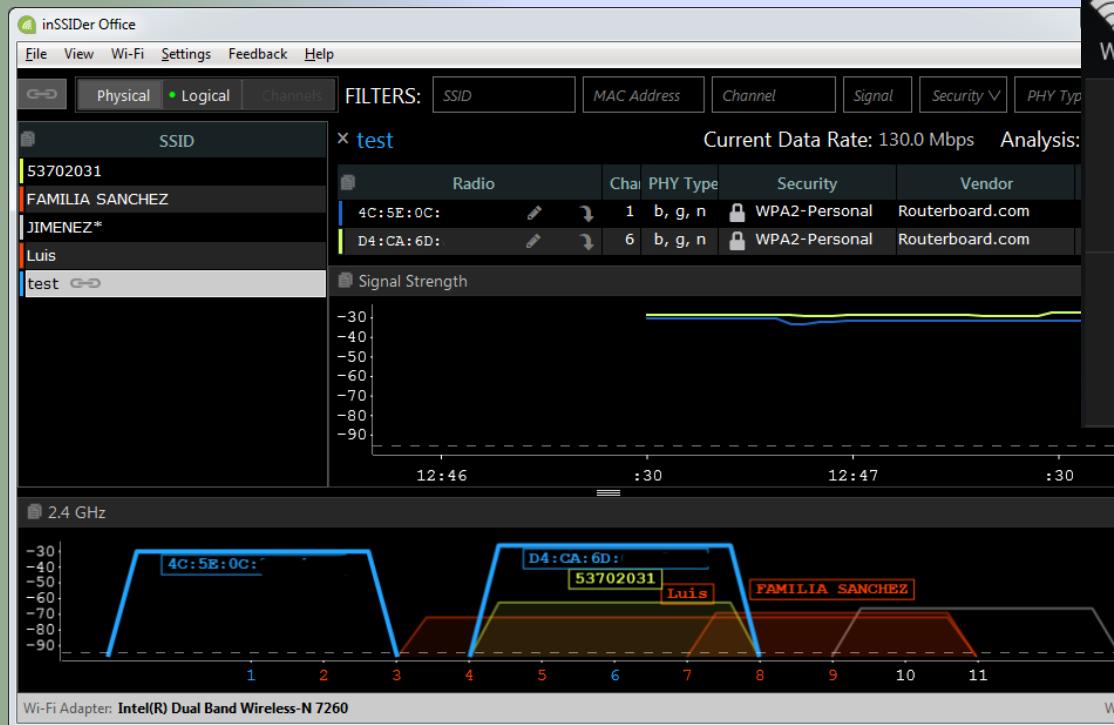
Objetivos e Importancia de una WLAN exitosa

- ## • Estabilidad



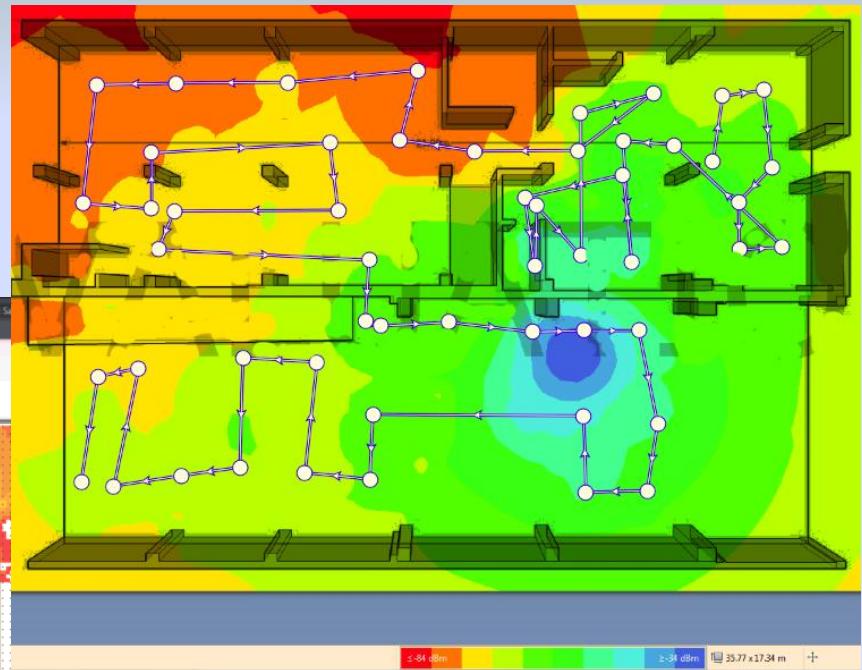
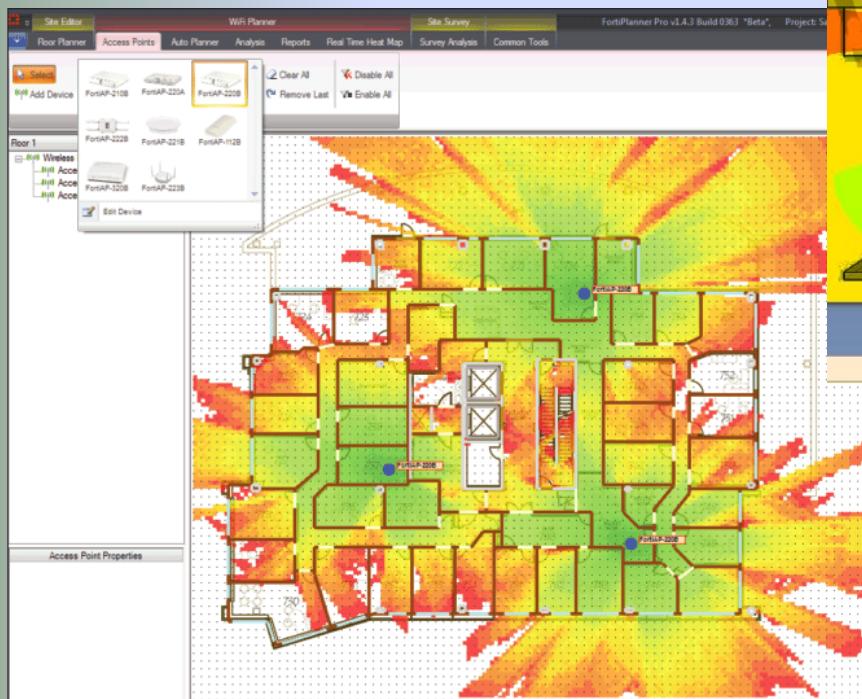
Objetivos e Importancia de una WLAN exitosa

- Confiabilidad



Importancia del Site Survey

- 80% del éxito del proyecto
- Cada escenario es diferente
- Evita sorpresas desagradables

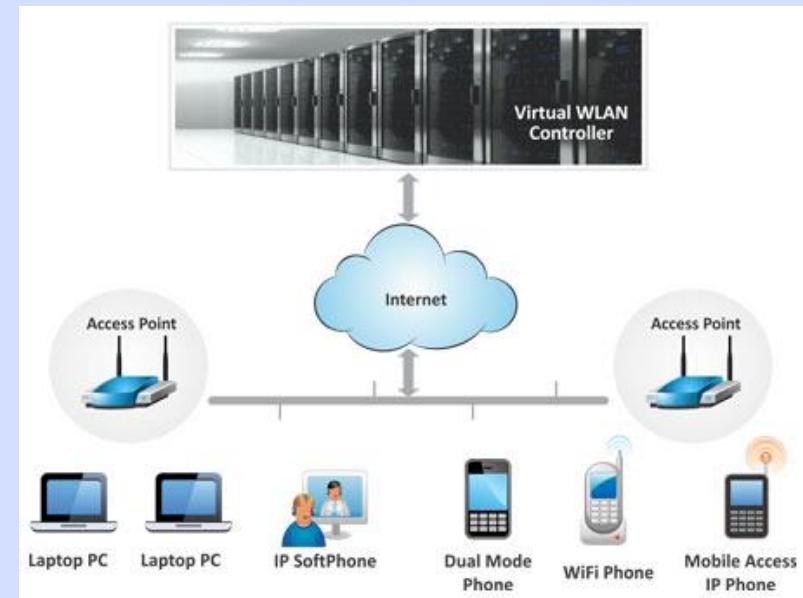


Recomendaciones de Diseño

- Escenario actual de las WLAN:
 - La cobertura no lo es todo
 - Alta densidad y alta capacidad
 - Contraintuitivo
 - Interferencia.
 - Dispositivos cliente

Recomendaciones de Diseño

- Evalúe la infraestructura existente, limitaciones y mejoras
 - Desempeño de la infraestructura
 - DHCP y DNS confiables
 - Switch Administrables
 - Control de tráfico
 - Cableado y Energía
 - Monitoreo



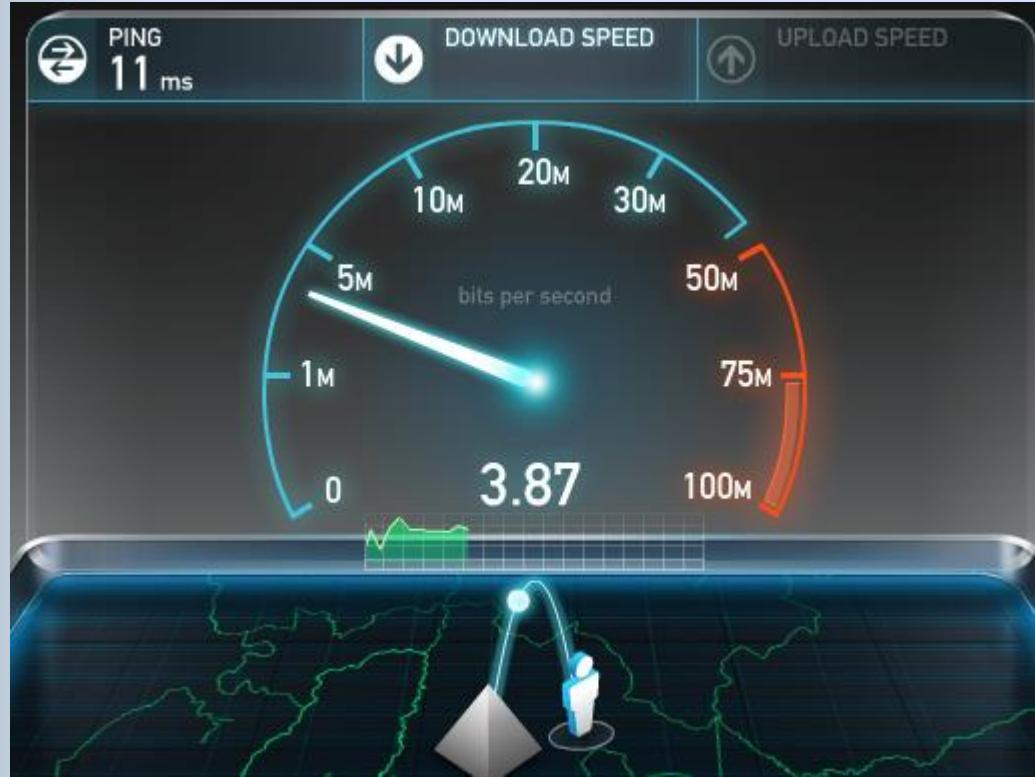
Recomendaciones de Diseño

- Establezca necesidades del cliente :
 - Asesoria vs Limitaciones.
 - Genere un checklist.
- Escuche y asesore al cliente.



Recomendaciones de Diseño

- Ancho de banda disponible y la estabilidad del servicio del ISP.



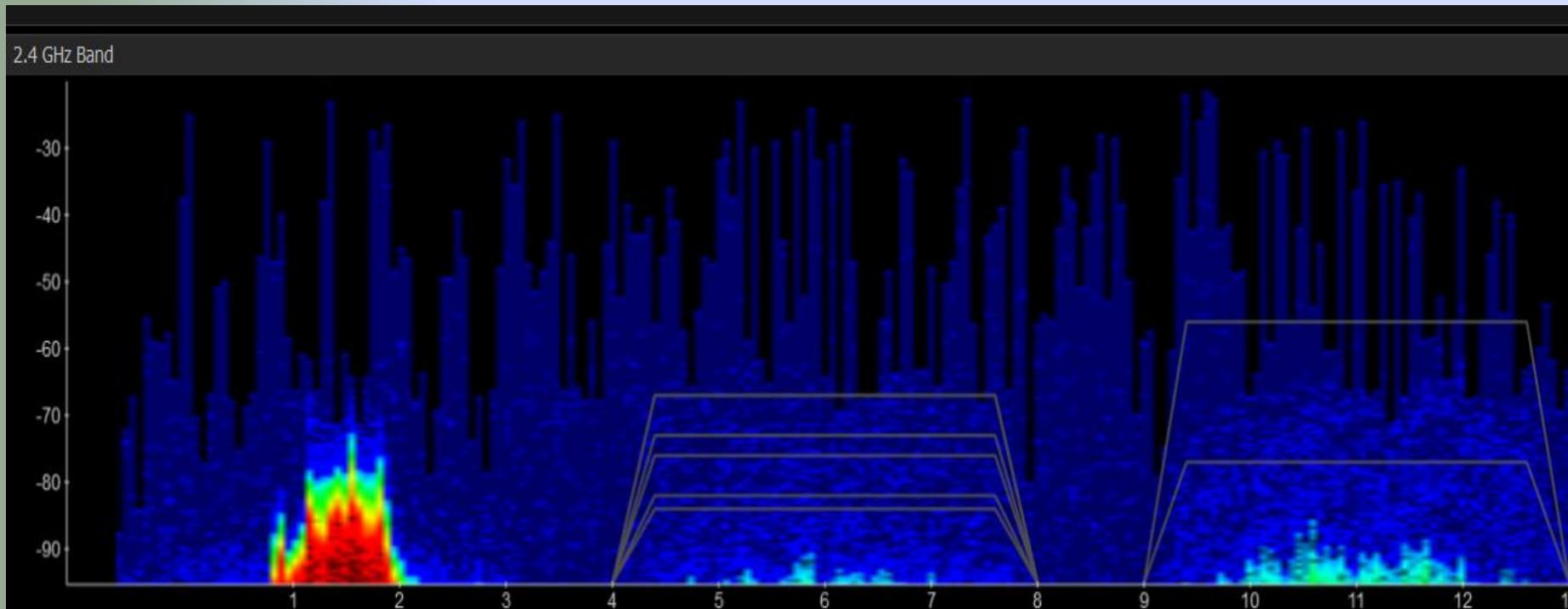
Recomendaciones de Diseño

- Evalúe el entorno en busca de posibles fuentes de interferencia u obstrucción y establezca la disponibilidad de espectro.



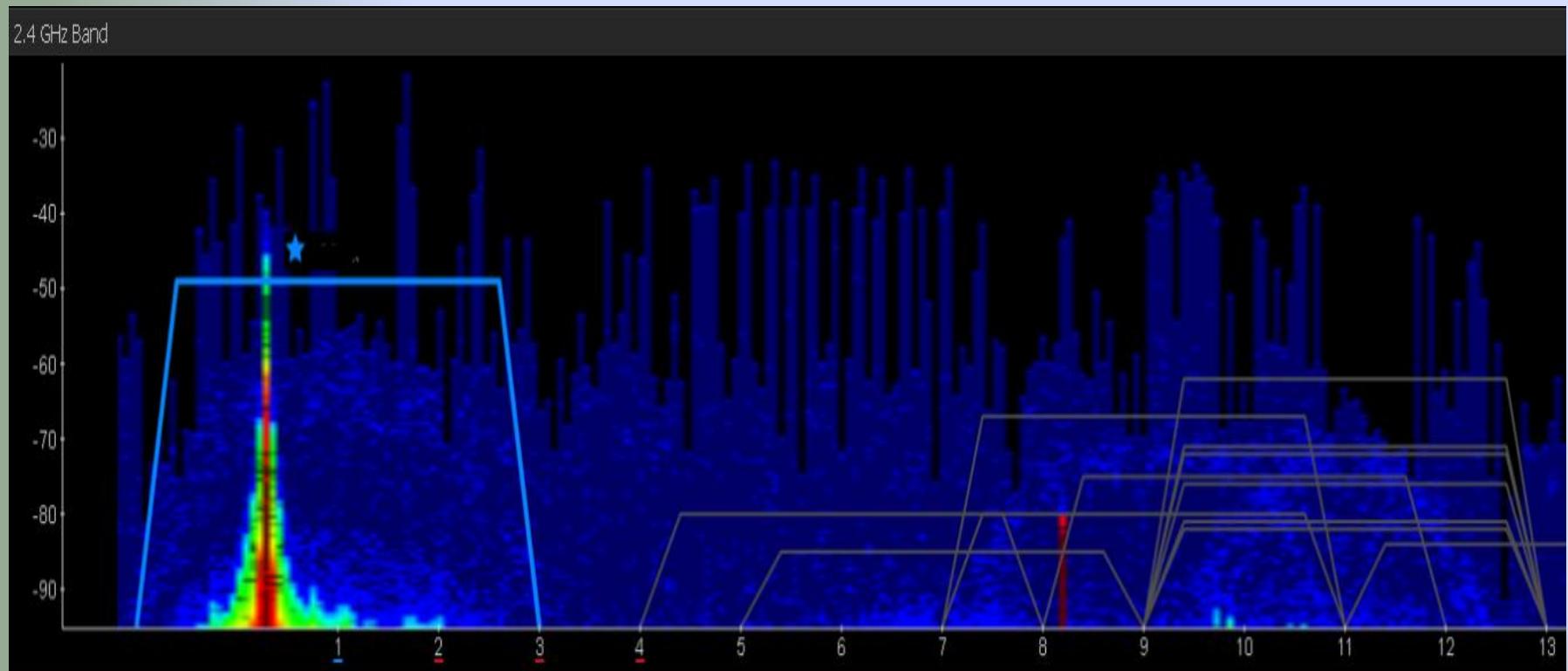
Fuentes de interferencia

Radio-enlaces



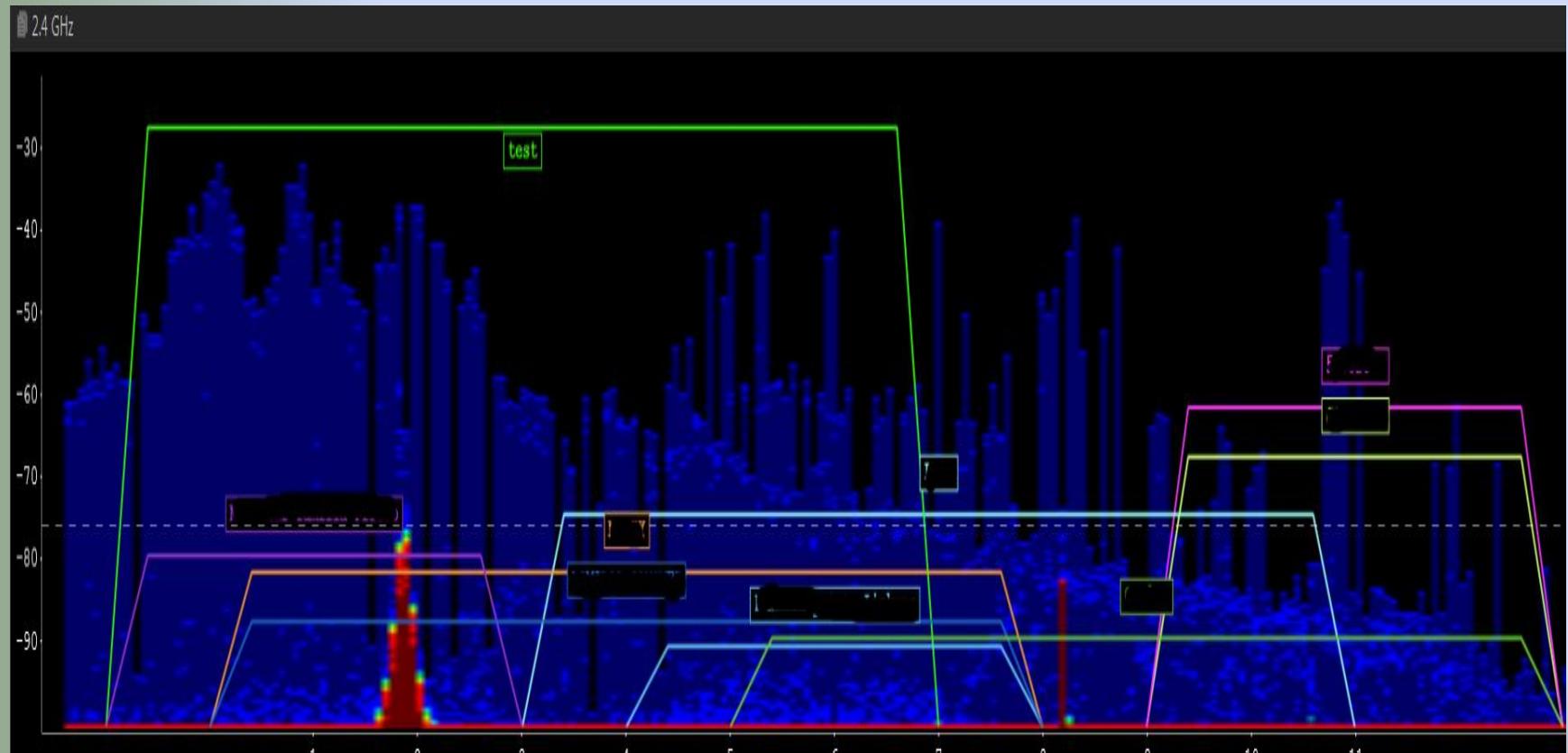
Fuentes de interferencia

Telefonos inalambricos

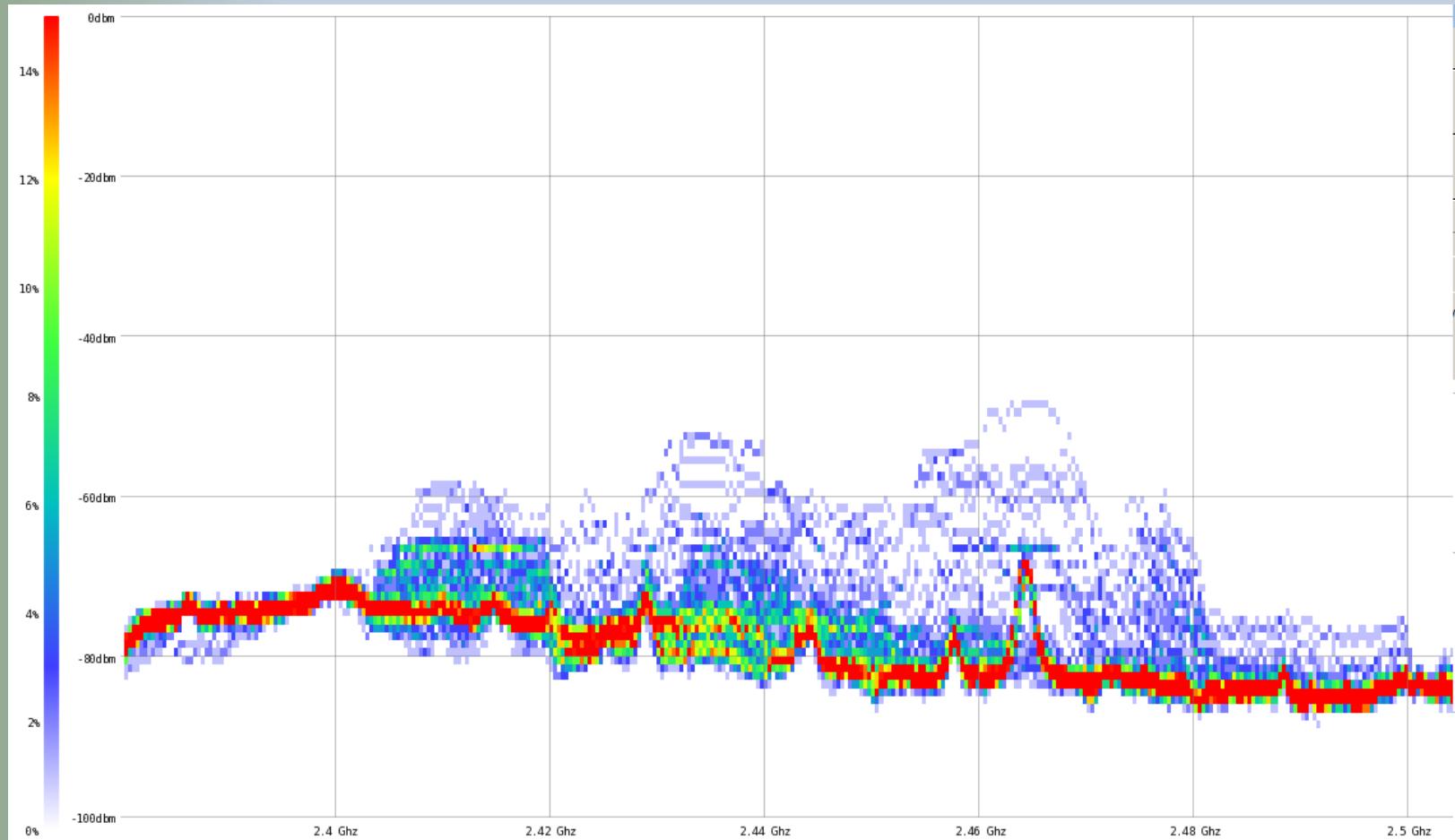


Fuentes de interferencia

Dispositivos desconocidos

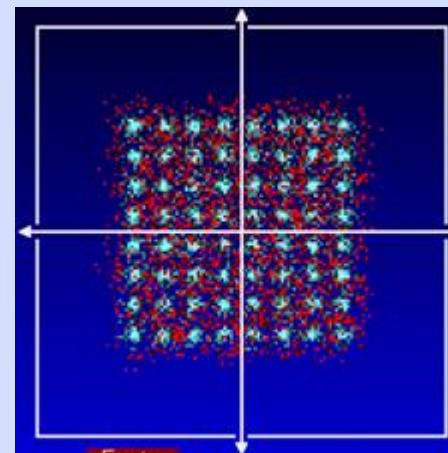


Análisis usando Mikrotik y The dude



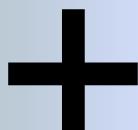
Funcionalidades Mikrotik

- Manipulación de **MCS**/Datarates
- **Modulation and Coding Scheme:** Esquema que combinaciones de modulación y codificación que permiten que la comunicación se adapte a las condiciones del enlace.
- La manipulación de MSC No es compatible con CAPsMAN



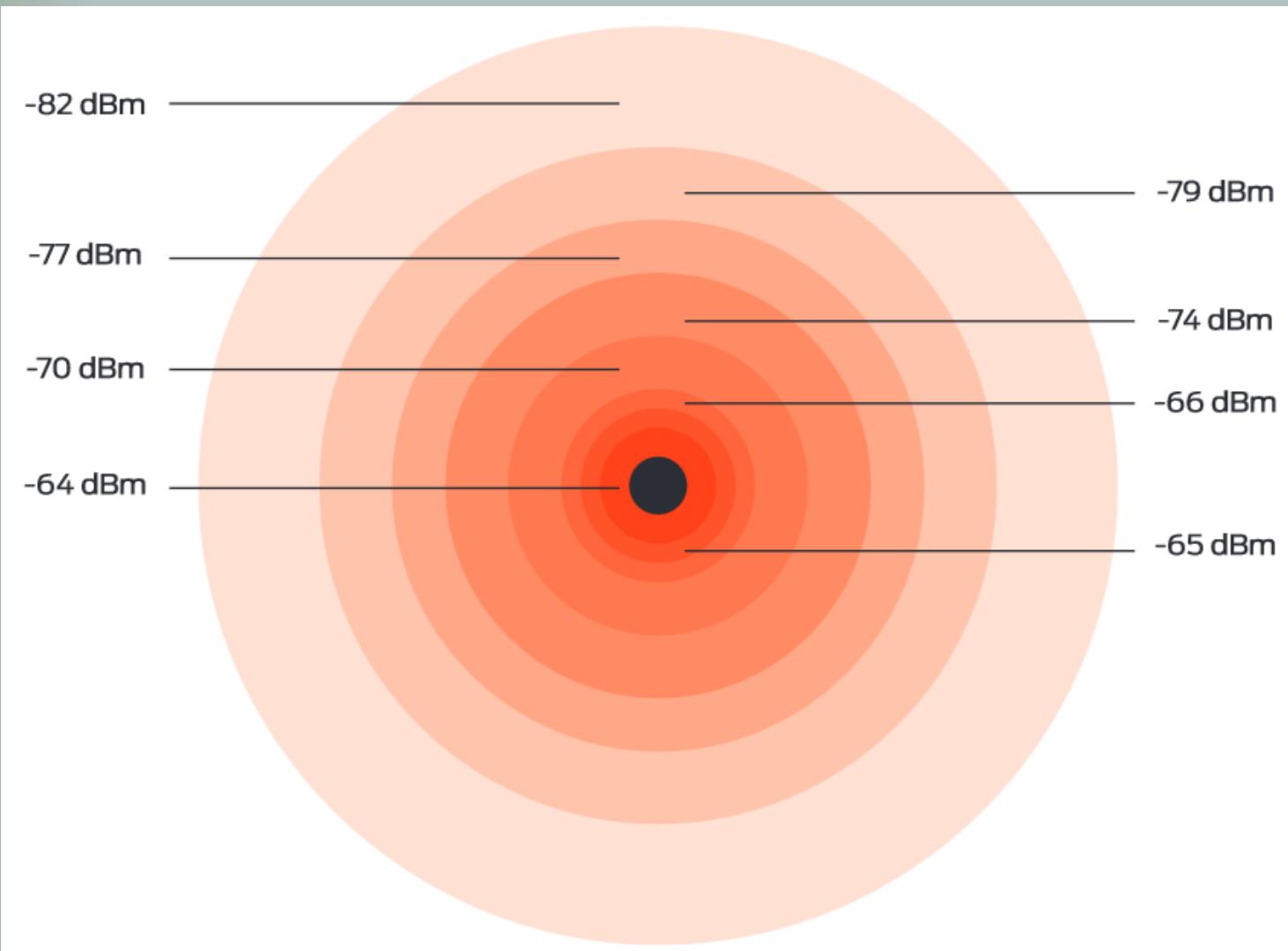
Manipulación de MCS/Datarates

Requiere
mejor
señal

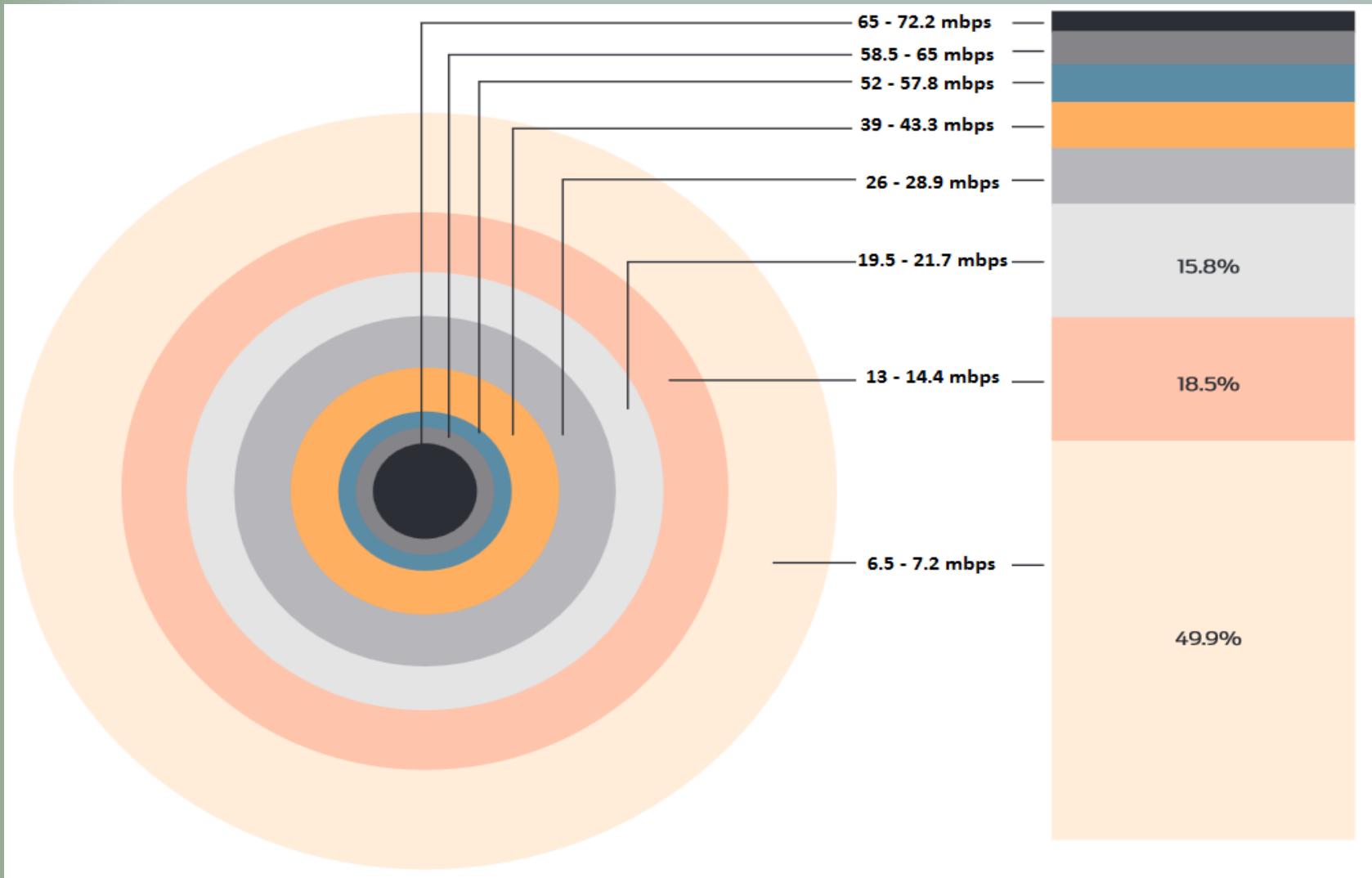


| MCS index | Spatial streams | Modulation type | Coding rate | Data rate | |
|-----------|-----------------|-----------------|-------------|----------------|-----------|
| | | | | 20 MHz channel | |
| | | | | 800 ns GI | 400 ns GI |
| 0 | 1 | BPSK | 1/2 | 6.5 | 7.2 |
| 1 | 1 | QPSK | 1/2 | 13 | 14.4 |
| 2 | 1 | QPSK | 3/4 | 19.5 | 21.7 |
| 3 | 1 | 16-QAM | 1/2 | 26 | 28.9 |
| 4 | 1 | 16-QAM | 3/4 | 39 | 43.3 |
| 5 | 1 | 64-QAM | 2/3 | 52 | 57.8 |
| 6 | 1 | 64-QAM | 3/4 | 58.5 | 65 |
| 7 | 1 | 64-QAM | 5/6 | 65 | 72.2 |

Manipulación de MCS/Datarates

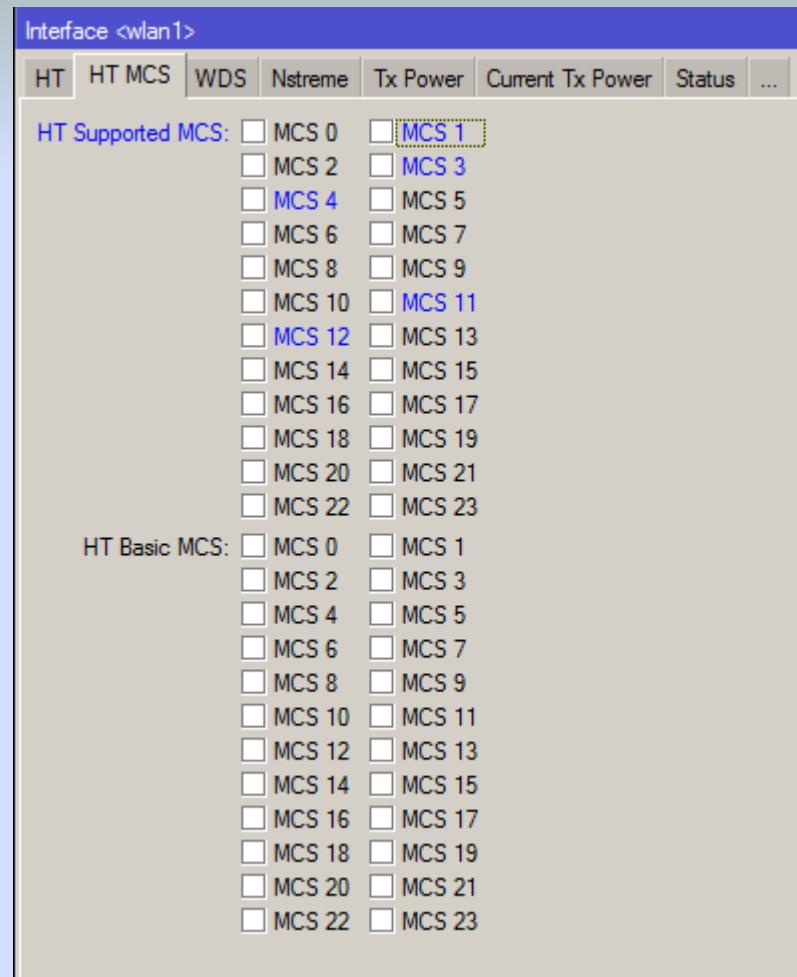
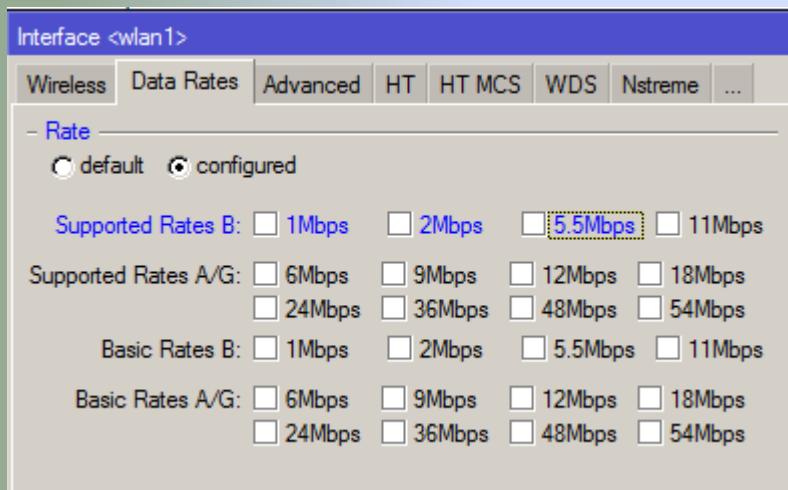


Manipulación de MCS/Datarates



Manipulación de MCS/Datarates

Mikrotik permite manipular el conjunto de MCS que el AP utilizará para transmitir



Manipulación de MCS/Datarates

Ejemplo 1

Permitir solo Modulación 64QAM.

Util para escenarios de alta densidad

Interface <wlan1>

Wireless Data Rates Advanced HT HT MCS WDS Nstreme ...

- Rate

default configured

Supported Rates B: 1Mbps 2Mbps 5.5Mbps 11Mbps

Supported Rates A/G: 6Mbps 9Mbps 12Mbps 18Mbps
 24Mbps 36Mbps 48Mbps 54Mbps

Basic Rates B: 1Mbps 2Mbps 5.5Mbps 11Mbps

Basic Rates A/G: 6Mbps 9Mbps 12Mbps 18Mbps
 24Mbps 36Mbps 48Mbps 54Mbps

Interface <wlan1>

HT HT MCS WDS Nstreme Tx Power Current Tx Power Status ...

HT Supported MCS: MCS 0 MCS 1
 MCS 2 MCS 3
 MCS 4 MCS 5
 MCS 6 MCS 7
 MCS 8 MCS 9
 MCS 10 MCS 11
 MCS 12 MCS 13
 MCS 14 MCS 15
 MCS 16 MCS 17
 MCS 18 MCS 19
 MCS 20 MCS 21
 MCS 22 MCS 23

HT Basic MCS: MCS 0 MCS 1
 MCS 2 MCS 3
 MCS 4 MCS 5
 MCS 6 MCS 7
 MCS 8 MCS 9
 MCS 10 MCS 11
 MCS 12 MCS 13
 MCS 14 MCS 15
 MCS 16 MCS 17
 MCS 18 MCS 19
 MCS 20 MCS 21
 MCS 22 MCS 23

Manipulación de MCS/Datarates

Interface <wlan1>

HT MCS WDS Nstreme Tx Power Current Tx Power Status ...

HT Supported MCS:

| | |
|--|--|
| <input type="checkbox"/> MCS 0 | <input checked="" type="checkbox"/> MCS 1 |
| <input type="checkbox"/> MCS 2 | <input checked="" type="checkbox"/> MCS 3 |
| <input checked="" type="checkbox"/> MCS 4 | <input checked="" type="checkbox"/> MCS 5 |
| <input checked="" type="checkbox"/> MCS 6 | <input checked="" type="checkbox"/> MCS 7 |
| <input type="checkbox"/> MCS 8 | <input type="checkbox"/> MCS 9 |
| <input type="checkbox"/> MCS 10 | <input checked="" type="checkbox"/> MCS 11 |
| <input checked="" type="checkbox"/> MCS 12 | <input checked="" type="checkbox"/> MCS 13 |
| <input checked="" type="checkbox"/> MCS 14 | <input checked="" type="checkbox"/> MCS 15 |
| <input type="checkbox"/> MCS 16 | <input type="checkbox"/> MCS 17 |
| <input type="checkbox"/> MCS 18 | <input type="checkbox"/> MCS 19 |
| <input type="checkbox"/> MCS 20 | <input type="checkbox"/> MCS 21 |
| <input type="checkbox"/> MCS 22 | <input type="checkbox"/> MCS 23 |

HT Basic MCS:

| | |
|---------------------------------|---------------------------------|
| <input type="checkbox"/> MCS 0 | <input type="checkbox"/> MCS 1 |
| <input type="checkbox"/> MCS 2 | <input type="checkbox"/> MCS 3 |
| <input type="checkbox"/> MCS 4 | <input type="checkbox"/> MCS 5 |
| <input type="checkbox"/> MCS 6 | <input type="checkbox"/> MCS 7 |
| <input type="checkbox"/> MCS 8 | <input type="checkbox"/> MCS 9 |
| <input type="checkbox"/> MCS 10 | <input type="checkbox"/> MCS 11 |
| <input type="checkbox"/> MCS 12 | <input type="checkbox"/> MCS 13 |
| <input type="checkbox"/> MCS 14 | <input type="checkbox"/> MCS 15 |
| <input type="checkbox"/> MCS 16 | <input type="checkbox"/> MCS 17 |
| <input type="checkbox"/> MCS 18 | <input type="checkbox"/> MCS 19 |
| <input type="checkbox"/> MCS 20 | <input type="checkbox"/> MCS 21 |
| <input type="checkbox"/> MCS 22 | <input type="checkbox"/> MCS 23 |

Ejemplo 2

Permitir solo Modulación 64QAM y 16QAM.

Interface <wlan1>

Wireless Data Rates Advanced HT HT MCS WDS Nstreme ...

- Rate -

default configured

Supported Rates B: 1Mbps 2Mbps 5.5Mbps 11Mbps

Supported Rates A/G: 6Mbps 9Mbps 12Mbps 18Mbps
 24Mbps 36Mbps 48Mbps 54Mbps

Basic Rates B: 1Mbps 2Mbps 5.5Mbps 11Mbps

Basic Rates A/G: 6Mbps 9Mbps 12Mbps 18Mbps
 24Mbps 36Mbps 48Mbps 54Mbps

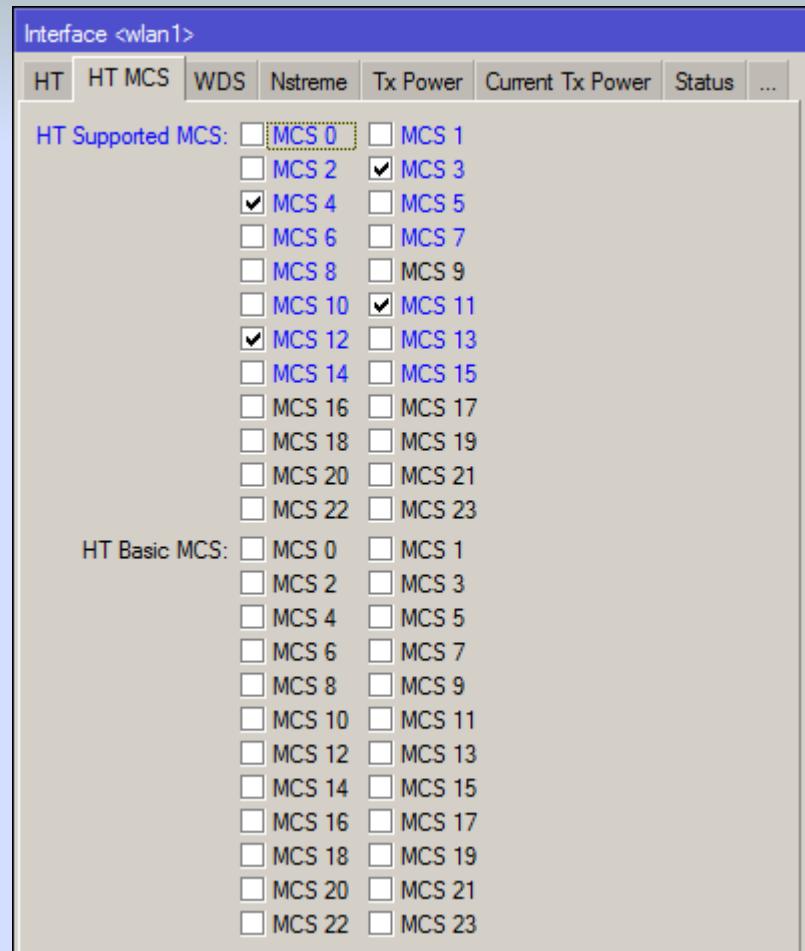
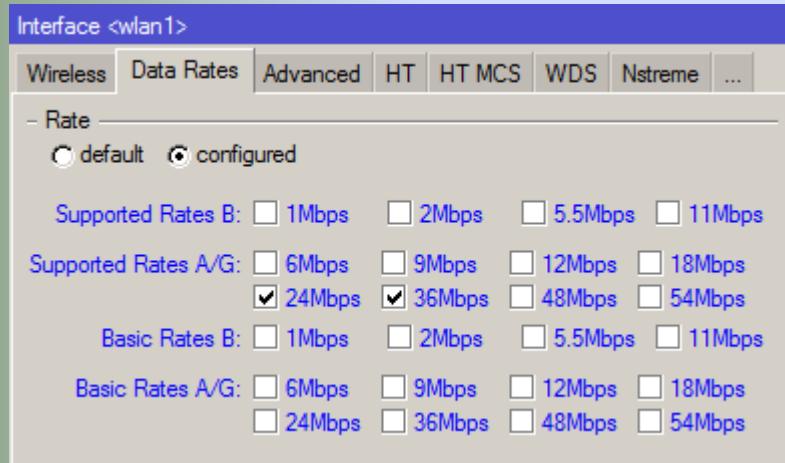
Manipulación de MCS/Datarates

Ejemplo 3

Permitir solo Modulación 16QAM.

Para entornos hostiles

Sacrifica rendimiento



Control de potencia TX

Util para ajustar la cobertura del AP e interferencia

| Interface <wlan1> | | | | |
|-----------------------|----------|--------------|------------------|--------|
| WDS | Nstreme | Tx Power | Current Tx Power | Status |
| - Current Tx Powers - | | | | |
| Rate | Tx Power | Real Tx P... | Total Tx ... | |
| 1Mbps | 26dBm | 26dBm | 29dBm | |
| 2Mbps | 26dBm | 26dBm | 29dBm | |
| 5.5Mbps | 26dBm | 26dBm | 29dBm | |
| 11Mbps | 25dBm | 25dBm | 28dBm | |
| 6Mbps | 27dBm | 27dBm | 30dBm | |
| 9Mbps | 27dBm | 27dBm | 30dBm | |
| 12Mbps | 27dBm | 27dBm | 30dBm | |
| 18Mbps | 27dBm | 27dBm | 30dBm | |
| 24Mbps | 27dBm | 27dBm | 30dBm | |
| 36Mbps | 25dBm | 25dBm | 28dBm | |
| 48Mbps | 23dBm | 23dBm | 26dBm | |
| 54Mbps | 22dBm | 22dBm | 25dBm | |
| HT20-0 | 27dBm | 27dBm | 30dBm | |
| HT20-1 | 26dBm | 26dBm | 29dBm | |
| HT20-2 | 26dBm | 26dBm | 29dBm | |
| HT20-3 | 26dBm | 26dBm | 29dBm | |
| HT20-4 | 26dBm | 26dBm | 29dBm | |
| HT20-5 | 26dBm | 26dBm | 29dBm | |
| HT20-6 | 23dBm | 23dBm | 26dBm | |
| HT20-7 | 20dBm | 20dBm | 23dBm | |

| Interface <wlan1> | | | | |
|-----------------------|----------|--------------|------------------|--------|
| WDS | Nstreme | Tx Power | Current Tx Power | Status |
| - Current Tx Powers - | | | | |
| Rate | Tx Power | Real Tx P... | Total Tx ... | |
| 1Mbps | 5dBm | 5dBm | 8dBm | |
| 2Mbps | 5dBm | 5dBm | 8dBm | |
| 5.5Mbps | 5dBm | 5dBm | 8dBm | |
| 11Mbps | 5dBm | 5dBm | 8dBm | |
| 6Mbps | 5dBm | 5dBm | 8dBm | |
| 9Mbps | 5dBm | 5dBm | 8dBm | |
| 12Mbps | 5dBm | 5dBm | 8dBm | |
| 18Mbps | 5dBm | 5dBm | 8dBm | |
| 24Mbps | 5dBm | 5dBm | 8dBm | |
| 36Mbps | 5dBm | 5dBm | 8dBm | |
| 48Mbps | 5dBm | 5dBm | 8dBm | |
| 54Mbps | 5dBm | 5dBm | 8dBm | |
| HT20-0 | 5dBm | 5dBm | 8dBm | |
| HT20-1 | 5dBm | 5dBm | 8dBm | |
| HT20-2 | 5dBm | 5dBm | 8dBm | |
| HT20-3 | 5dBm | 5dBm | 8dBm | |
| HT20-4 | 5dBm | 5dBm | 8dBm | |
| HT20-5 | 5dBm | 5dBm | 8dBm | |
| HT20-6 | 5dBm | 5dBm | 8dBm | |
| HT20-7 | 5dBm | 5dBm | 8dBm | |

Funcionalidades Mikrotik

- Control Intensidad de Señal RX
- Util para mitigar la conexión de los vecinos
- Control clientes por intensidad de señal.
- Desconexion por umbral



Ejemplo

Ejemplo:

| Wireless Tables | | | | | | | | |
|-----------------|-------------|--------------|-----------------------|----------------|--------------|--------------|-------------------|----------|
| Interfaces | | Nstreme Dual | | Access List | Registration | Connect List | Security Profiles | Channels |
| # | MAC Address | Interface | Signal Strength Range | Authentication | Forwarding | | | |
| 0 | ↔ | all | -120..-73 | no | no | | | |
| 1 | ↔ | all | -78..120 | yes | yes | | | |

2 items

- Wireless access-list

Funcionalidades Mikrotik

- Control de Tráfico
- Todo el QoS de RouterOS en el AP
- Control de tiempo al aire
- Balance de tráfico

Control de Tráfico

Ejemplo:

The top screenshot shows the Queue List configuration for download traffic. It includes a table with columns for Type, Name, Kind, and Rate. Two entries are present: 'pcq-download-default' with a rate of 10M and 'pcq-upload-default' with a rate of 3M.

| Type | Name | Kind | Rate |
|------|----------------------|------|------|
| pcq | pcq-download-default | pcq | 10M |
| pcq | pcq-upload-default | pcq | 3M |

The bottom screenshot shows the Queue List configuration for upload traffic. It includes a table with columns for #, Name, Target, Upload Max Limit, Download Max Limit, and P. One entry is shown: 'queue1' with a target of 192.168.0.0/16, an upload limit of 5M, and a download limit of 15M.

| # | Name | Target | Upload Max Limit | Download Max Limit | P |
|---|--------|----------------|------------------|--------------------|---|
| 0 | queue1 | 192.168.0.0/16 | 5M | 15M | |

| Queue List | | | | |
|-----------------------------------|-----------------------------------|-------------------------------------|-----------------------------------|-----------------------------------|
| Simple Queues | | Interface Queues | | Queue Tree |
| <input type="button" value="+"/> | <input type="button" value="-"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="button" value="X"/> |
| <input type="button" value="F1"/> | <input type="button" value="F2"/> | <input type="button" value="F3"/> | <input type="button" value="F4"/> | <input type="button" value="F5"/> |
| 00 | Reset Counters | 00 | Reset All Counters | |
| Name | Limit | At ... | Max Limi... | A |
| TOTAL_W | 15M | 1 | | |
| TOTAL_D | 15M | | | |
| 1_ACK_D | 500k | 15M | | |
| 1_DNS_D | 100k | 15M | | |
| 1_ICMP_D | 100k | 15M | | |
| 1_VOIP_D | 500k | 15M | | |
| 4_IPSEC_D | 100k | 15M | | |
| 4_RDP_D | 100k | 15M | | |
| 4_WINBOX_D | 100k | 15M | | |
| 5_HTTP_D | 100k | 15M | | |
| 5_OTHER_D | 100k | 15M | | |
| 6_HTTP_BIG_D | 100k | 15M | | |
| 6_MAIL_D | 100k | 15M | | |
| 7_OTHER_BIG_D | 100k | 10M | | |
| TOTAL_U | 5M | 1 | | |
| 1_ACK_U | 500k | 5M | | |
| 1_DNS_U | 100k | 5M | | |
| 1_ICMP_U | 100k | 5M | | |
| 1_VOIP_U | 500k | 5M | | |
| 4_IPSEC_U | 100k | 5M | | |
| 4_RDP_U | 100k | 5M | | |
| 4_WINBOX_U | 100k | 5M | | |
| 5_HTTP_U | 100k | 5M | | |
| 5_OTHER_U | 100k | 5M | | |
| 6_HTTP_BIG_U | 100k | 5M | | |
| 6_MAIL_U | 100k | 5M | | |
| 7_OTHER_BIG_U | 100k | 5M | | |

Funcionalidades Mikrotik

- Firewall de hardware (RB951G)

| Feature | Atheros8327 |
|----------------|--------------|
| Port Switching | yes |
| Port Mirroring | yes |
| Host table | 2048 entries |
| Vlan table | 4096 entries |
| Rule table | 92 rules |

Firewall de hardware (RB951G)

Ejemplo:

Switch Rule <>

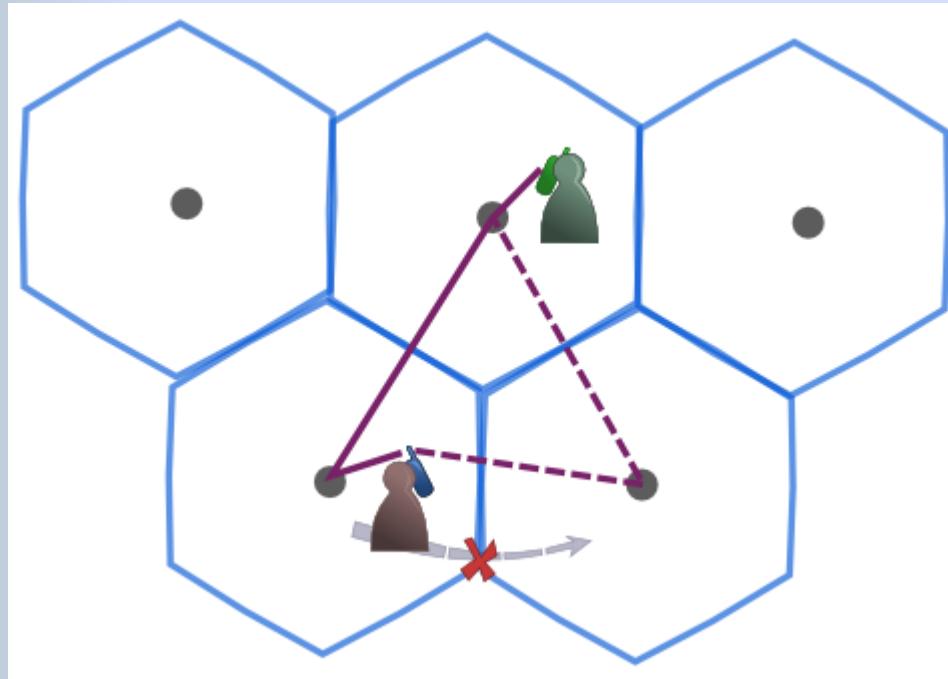
| | |
|------------------------------|----------------------------------|
| Match | Action |
| Switch: switch1 | <input type="checkbox"/> OK |
| Ports: switch1 cpu | <input type="checkbox"/> Cancel |
| Src. MAC Address: | <input type="checkbox"/> Apply |
| Dst. MAC Address: | <input type="checkbox"/> Disable |
| MAC Protocol: | <input type="checkbox"/> Copy |
| VLAN | <input type="checkbox"/> Remove |
| IP | |
| Src. Address: 192.168.0.0/16 | |
| Dst. Address: 8.8.8.8 | |
| Protocol: | |
| Src. Port: | |
| Dst. Port: | |
| DSCP: | |
| IP 6 | |
| enabled | |

Switch Rule <>

| | |
|---------|--|
| Match | Action |
| | <input type="checkbox"/> OK |
| | <input type="checkbox"/> Cancel |
| | <input type="checkbox"/> Apply |
| | <input type="checkbox"/> Disable |
| | <input type="checkbox"/> Copy |
| | <input type="checkbox"/> Remove |
| | <input checked="" type="checkbox"/> Set New Dst. Ports |
| | New Dst. Ports: <input type="text"/> |
| | New VLAN ID: <input type="text"/> |
| | New VLAN Priority: <input type="text"/> |
| enabled | |

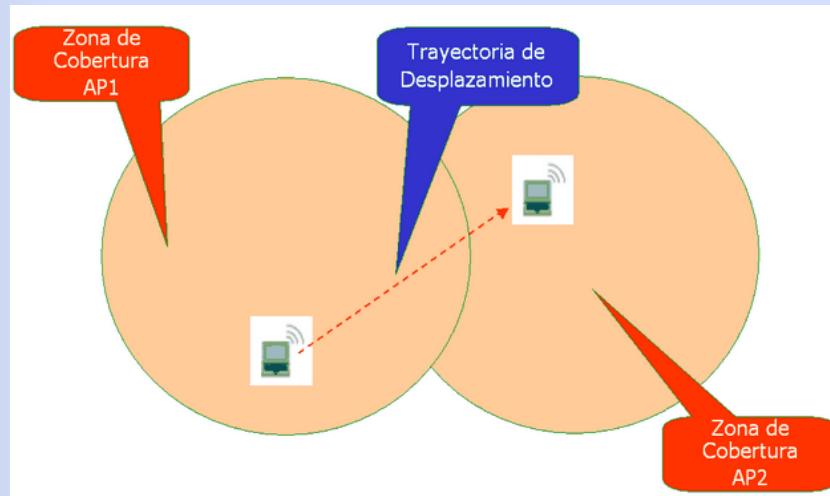
Mejorando el Roaming

Que es el roaming??



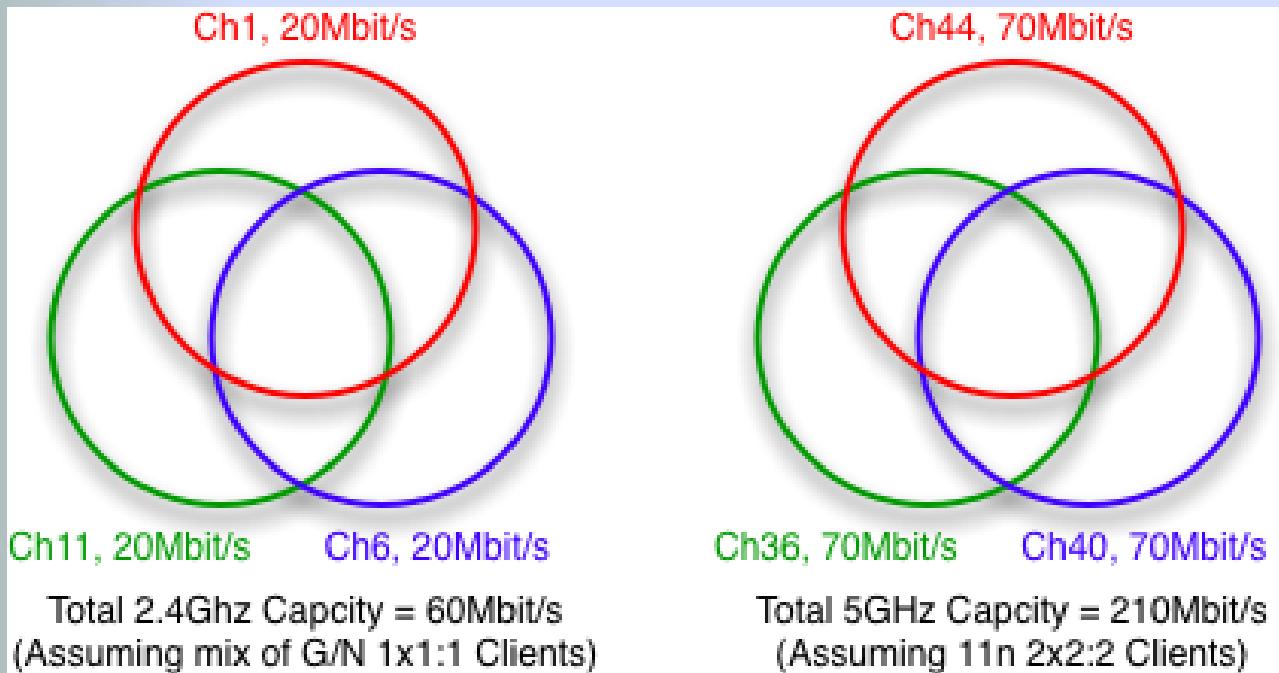
Como mejorar el roaming?

- Manipulación de MCS, Control de potencia TX, Access list wireless.



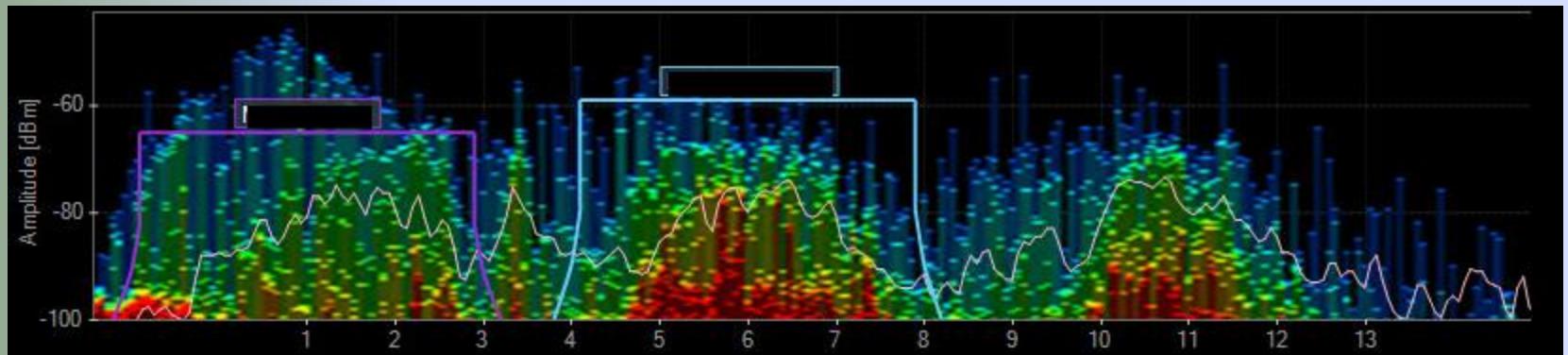
- Sticky Client

Mejorando la capacidad



Como mejorar la capacidad?

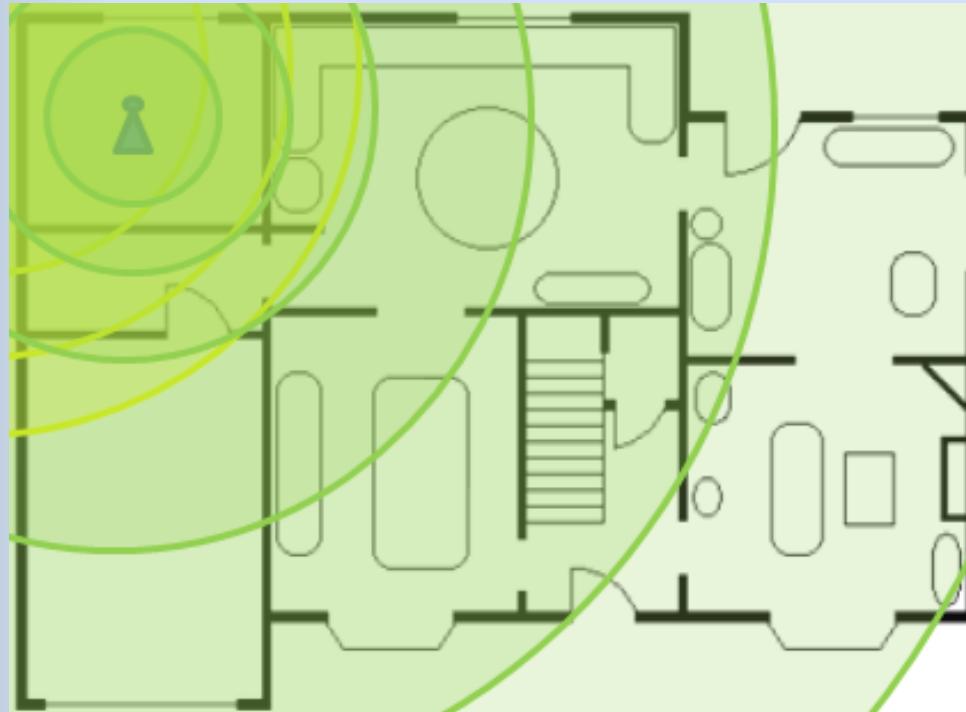
- Reduzca la interferencia co-canal



- Optimize al máximo el reuso de canales

Mejorando La Cobertura

Aproveche el entorno.



Velocidad Real

| DATA RATE 802.11N 800NS GI 1SS 20MHZ | DESEMPEÑO TIPICO APROX |
|---|-----------------------------------|
| 65mbps | 31.0 mbps |
| 58,5mbps | 30.0 mbps |
| 52mbps | 28.0 mbps |
| 39mbps | 22.5 mbps |
| 26mbps | 16.5 mbps |
| 19,5mbps | 13.0 mbps |
| 13mbps | 9.0 mbps |
| 6,5mbps | 4.5 mbps |

Preguntas ???

Muchas
Gracias

Por: Sergio Acuña
QuickNET.co

sergio.acuna@quicknet.co



QuickNET.co